

Plains CO₂ Reduction (PCOR) Partnership (Phase II)

Burke County, North Dakota, Lignite Demonstration Site



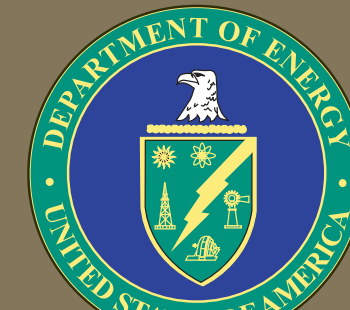
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Eagle Operating Inc.



Fischer Oil and Gas, Inc.



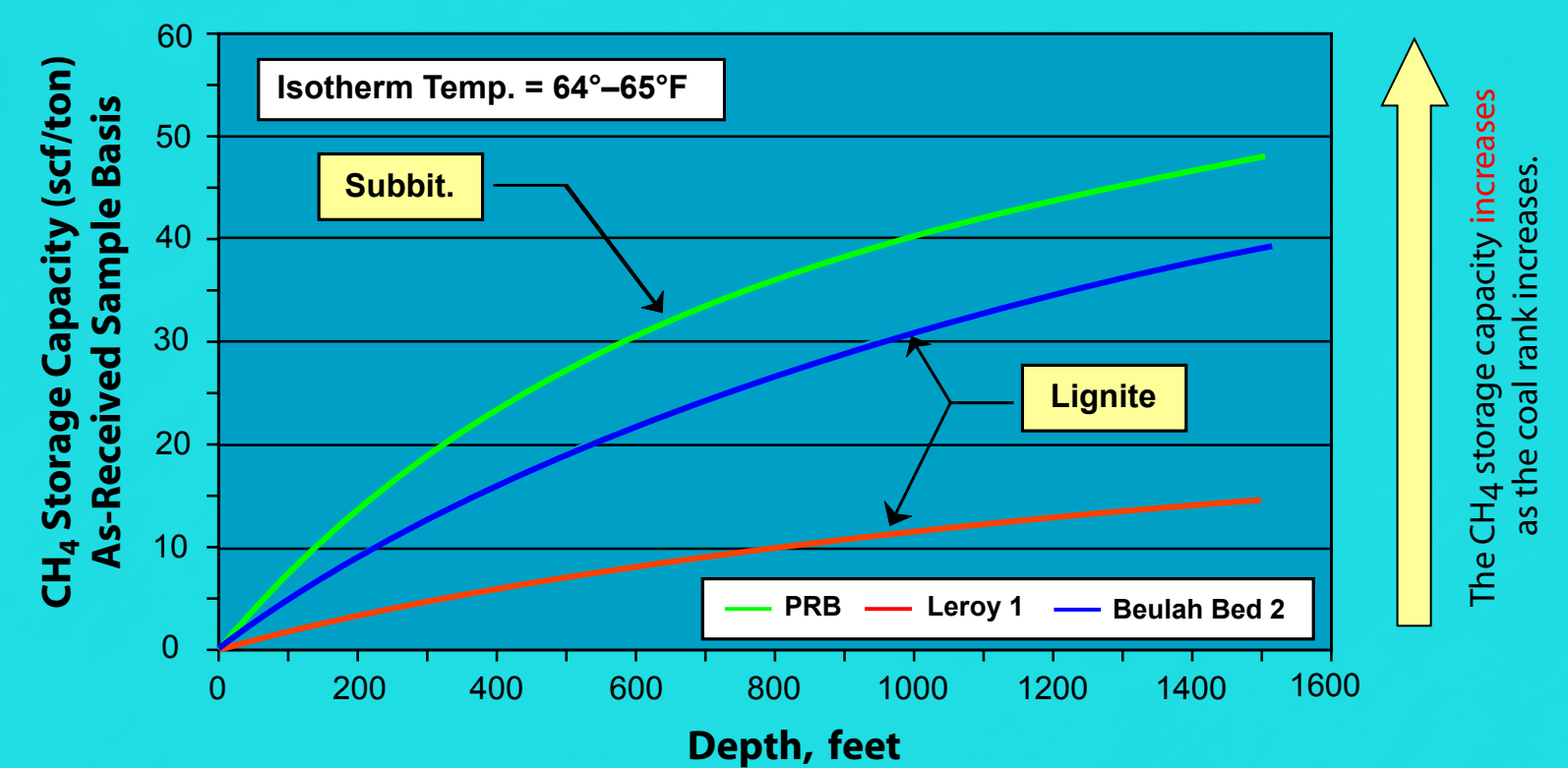
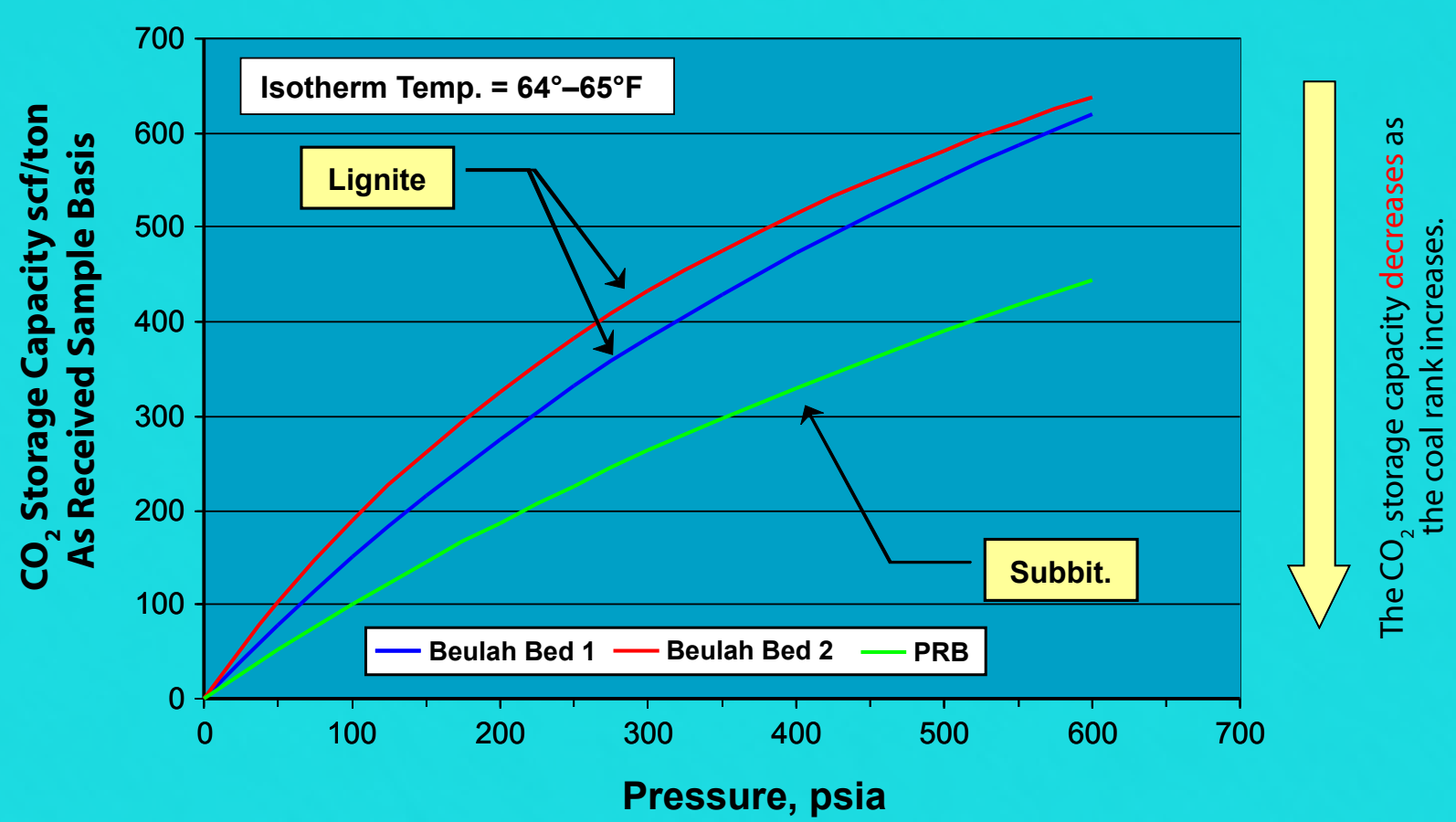
Unminable coal seams are believed to provide a viable opportunity for large-scale underground sequestration of carbon dioxide (CO₂). The opportunity looks even more attractive because of the possibility of simultaneous coalbed methane production.

The PCOR Partnership field validation test in Burke County, North Dakota, aims to evaluate CO₂ sequestration capacity and CH₄ production potential of North Dakota lignite resources. It is anticipated that the results of the test will be broadly applicable to similar projects in lignite seams and will reveal features having significance for CO₂ sequestration and CH₄ production in lignite.

Through the course of the test, the following aspects will be studied:

- Methane content and CO₂ storage capacity
- Assessment of existing and emerging experimental methods that estimate methane content and CO₂ storage capacity
- Effects of CO₂ on the physical and chemical properties of lignite under field conditions
- Characteristics of fluid transport
- Stability of stored CO₂
- Factors controlling the success of sequestration/production operations
- Economics of the operations

The test will be conducted in two phases. Phase 1 will focus on obtaining baseline data and studying methane production potential with no CO₂ injection into the formation. In Phase 2, CO₂ injection will begin, the goal of which is to investigate the feasibility of CO₂ storage in lignite and potential for enhanced coalbed methane (ECBM) production.



Acquisition and Verification

Baseline data acquisition will consist of laboratory and field-based assessments of the lignite seam's properties from core and petrophysical properties from a robust suite of well logs. Following CO₂ injection, a comprehensive set of monitoring and modeling activities will be conducted as part of the MMV program.

Testing Program

- Baseline data collection
 - Regional geology and stratigraphy
 - Lignite seam geometry
- Core studies
 - Gas content
 - Gas properties
 - Adsorption/desorption properties
 - Coal properties
- Field tests
 - Pump test to determine hydrogeologic regime
 - Injection test to examine changes in coal permeability due to swelling

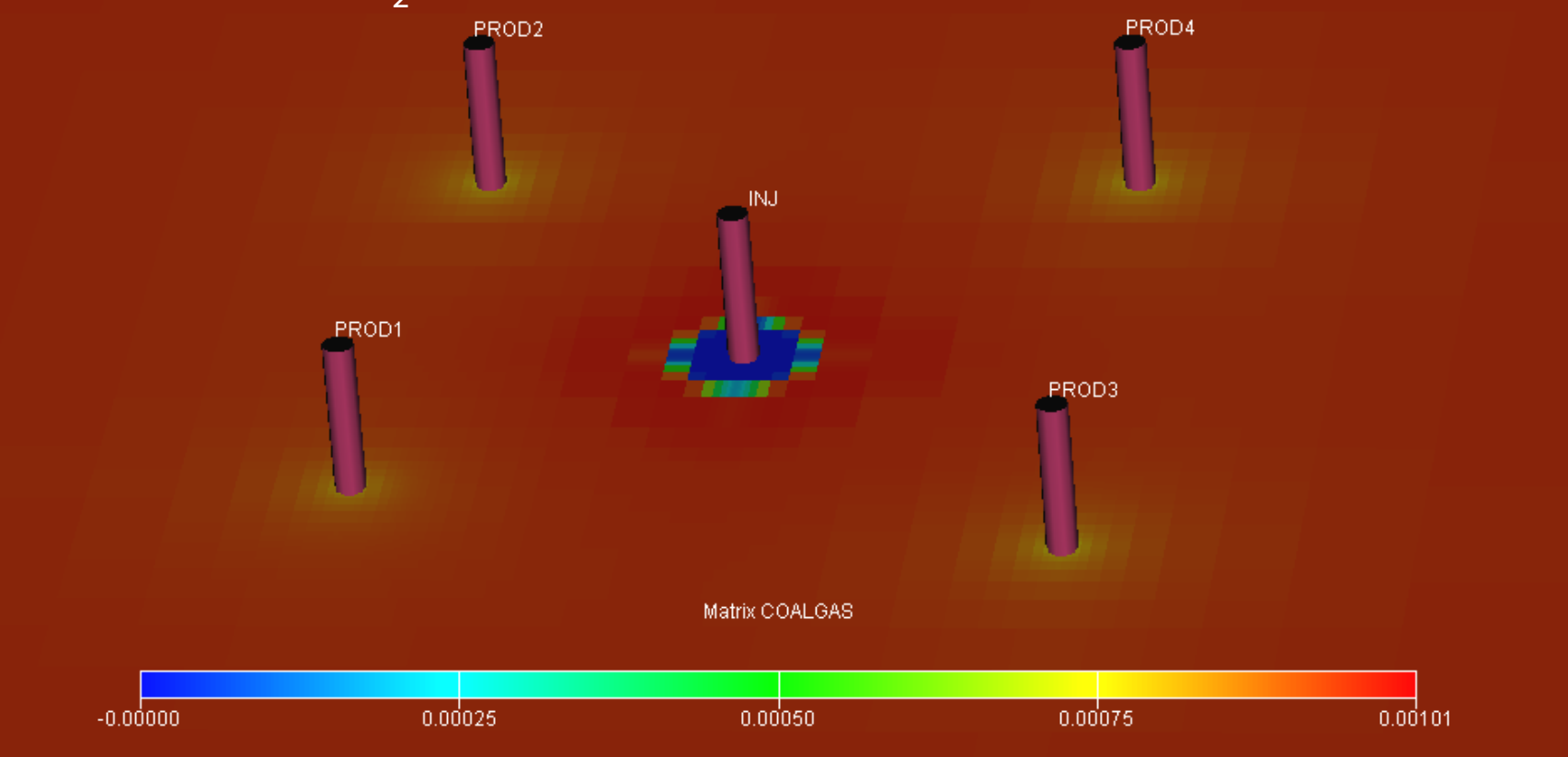
- Logging
 - Schlumberger's Platform Express which includes:
 - Resistivity
 - Lithology – density
 - Gamma ray
 - Neutron porosity
 - Caliper
 - Spontaneous potential
 - Will also collect:
 - Modular sonic logging
 - Acoustical
 - Mud log

Monitoring, Mitigation, and Verification Program

- Site design to allow for efficient monitoring
 - Zonal isolation
 - Perforation of the producing interval in producers
 - Installation of pressure measurement devices in all five wells
- Insitu monitoring
 - Pressure
 - Regular formation fluid sampling from different horizons
 - Tiltmeter array monitoring (anticipated)
- Modeling
 - Creation and validation of the numerical model
 - Making predictions on CO₂ fate within lignite bed using validated model
 - Continuous insitu monitoring to ensure the accuracy of predictions

Input Parameters and Preliminary Results of Simulations using Schlumberger's Eclipse Software

Simulated Methane Saturation in Lignite after the Injection of 400 tons of CO₂



Characteristics	Reported Value
Depth <i>H</i> , ft	1040–1175
Reservoir Temperature <i>T</i> , °F	70.8–73.5
Reservoir Pressure, psi	478.4–540.4
Coal Thickness <i>h</i> , ft	7–9
CO ₂ Langmuir Pressure <i>PLCO₂</i> , psi	528–1150.2
CO ₂ Langmuir Volume <i>VLCO₂</i> , scf/ton	1125–1779
CH ₄ Langmuir Pressure <i>PLCH₄</i> , psi	518.26
CH ₄ Langmuir Volume <i>VLCH₄</i> , scf/ton	71.42
Ash Content, %	6.0–8.8
Moisture Content, %	24.1–39.2
Coal Gas Concentration <i>C</i> , scf/ton	0.02–22.68
Coal Density	1.29–1.75
Diffusion Coefficient <i>D</i> , ft ² /day	0.358–49.2 × 10 ⁻⁷
Desorption Time <i>t</i> , h	3.76–516.9

